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EXAMINER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

<table>
<tr><td rowspan="2">Office Action Summary</td><td>Application No.
10/723,160</td><td>Applicant(s)
MILLER ET AL.</td><td></td></tr>
<tr><td>Examiner
Carlene Gordon</td><td>Art Unit
2165</td><td></td></tr>
</table>

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

> A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
> - Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
> - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
> - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
> Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>19 September 2007</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-20</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-20</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some *   c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>09/27/2007</u>.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application

6)☐ Other: _____ .

DETAILED ACTION

1.   This application has been examined.

Claims 1-20 are pending.

Claim Rejections - 35 USC § 112

2.   The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3.   Claims 1, 18, and 20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The newly added limitation: the subtree comprising at least one node that is not a leaf node of the tree representation is not supported by the original disclosure of the specification as outlined by Applicant on page 12, line 18, to page 13, line 8 and Fig. 3B of the Drawings, thereby is raised as new matter.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5.   Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Applicant's Admission of Prior Art (Pub. No. 2005/0114655 A1), hereinafter AAPA, in

view of Cheriton (USPN 7,149,216), hereinafter Cheriton, and further in view of Non-

Patent Literature ("Security Overview" by Instructor Joonwon Lee), hereinafter *Lee*.

a.   **Per claim 1,** *AAPA* discloses a method of generating a representation of

an access control list **(See pg. 1 paragraph [0003] where routers or switches**

typically utilize ACLs.), the representation being utilizable in a processor **(See pg. 1**

paragraph [0004] where network processors are used.), the method comprising the

steps of:

determining a plurality of rules of the access control list, each of at least a subset

of the rules having a plurality of fields and a corresponding action **(See page 1**

paragraph [0003] where an ACL generally comprises a set of rules, the rules

having fields and corresponding actions.).

AAPA does not explicitly disclose processing the rules to generate a multi-level

tree representation of the access control list, each of one or more of the levels of the

tree representation being associated with a corresponding one of the fields; and

wherein at least one level of the tree representation comprises a plurality of nodes.

However, *Cheriton* discloses the ACL having rules compiled into an ACL-M-trie

Plus data structure having multiple levels, and each level having of a plurality of nodes

being associated with fields, the fields included source and destination addresses **(See**

col. 2 lines 15-18 and 35-37, and col. 4 lines 5-9 where M-trie Plus data structure is

a multi-level tree.).

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art of generating Access Control Lists (ACLs) (AAPA) to generate a multi-

level tree representation of the access control list as taught by *Cheriton*. The motivation

would have been to provide a faster way of traversing the ACL due to earlier methods

being relatively slow **(See col. 1 lines 39-46 of Cheriton.).**

AAPA in view of *Cheritan* does not explicitly disclose that with two or more of the

nodes of a level having a common subtree, the tree representation including only a

single copy of that subtree; the tree representation being characterizable as a directed

graph in which each of the two nodes having the common subtree points to the single

copy of the common subtree.

However, *Lee* discloses two or more of the nodes of a level of a tree in a directed

graph representation having a common subtree pointing to a single copy of the common

subtree **(See pg. 12 where a plurality of nodes 'x & y' at one level points to one**

node 'z'. 'z' is a common subtree of nodes 'x' and 'y' which are of a certain level

above 'z'. Lee uses a directed graph characterization as found in claim

language.).

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art of generating Access Control Lists (ACLs) in a multi-level tree

representation (*AAPA* and *Cheritan*) to have two or more of the nodes of a level of the

tree in a directed graph representation having a common subtree pointing to a single

copy of the common subtree as taught by *Lee*. The motivation would have been to

optimize the ACL representation by improve speed further and reduce redundancy **(See**

pg. 9 of *Lee* where slow access of the list is a disadvantage.).

b.   **Per claim 2,** *AAPA* in view of *Cheritan* and *Lee* discloses the method of

claim 1, wherein the common subtree is implemented at least in part as a matching table

(AAPA See pg. 1 paragraph [0009] where ACL rules are stored in table format.

Also see [0003] where ACL typically imply an ordered matching or ordered list of

***AAPA*.).**

c.   **Per claim 3,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 1 wherein the plurality of fields comprises at least first and second fields, the first

field comprising a source address field and the second field comprising a destination

address field **(See pg. 1 paragraph [0003] where fields define source and**

destination addresses of *Cheriton*.).

d.   **Per claim 4,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of claim 1 wherein a final level of the tree representation comprises a plurality of leaf nodes, each associated with one of the actions of the plurality of rules **(See col. 2 lines 35-42, col. 3 lines 53-63, and col. 4 lines 5-9 of *Cheriton* where second level of nodes of the addresses is associated with routing rules.).**

e.   **Per claim 5,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of claim 1 wherein the at least one level of the tree representation comprises a root level of the tree representation **(See col. 4 lines 1-4 of *Cheriton* where tree , including roots; i.e. root level.).**

f.   **Per claim 6,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of claim 5 wherein a second level of the tree representation includes a plurality of nodes, each being associated with a subtree of a given one of the plurality of nodes of the root level of the tree representation **(See above in claim 1 where *Lee* teaches root level of nodes points to one particular subtree.).**

g.   **Per claim 7,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of claim 1 wherein for each level of the tree representation that corresponds to a field of a rule of the access control list **(See *Cheriton* col. 4 lines 35-41 where first and second levels corresponding to fields including source and destination address.),** a master list of nodes is maintained, each node comprising at least one of information

characterizing one or more field values associated with that node **(See *Cheriton* col. 3 lines 53-67 where extended ACL List is master list.)**, one or more subtree pointers for that node, and a reference count indicating how many ancestor nodes are pointing to that node **(See *Cheriton* col. 3 lines 46-51 where oppointer includes pointers for a node and opcode; i.e. subtree pointers and a reference count.)**.

     h.   **Per claim 8,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of claim 7 wherein the tree representation is generated by sequentially processing the rules of the access control list, the processing for a given rule comprising applying values of fields of the given rule to one or more existing nodes of the tree representation **(See col.1 lines 55-59 and col. 2 lines 15-19 of *Cheriton* for access control list processing.)**, and wherein when a particular value of a field of the given rule is applied to a given node **(See col. 2 lines 35-43 where sequence of nodes have applied source and destination address values, see col. 4 lines 5-9.)**.

    AAPA in view of *Cheriton* and *Lee does not explicitly* disclose a copy is made of the node, the field value is applied to the copied node, and the resultant updated node is added to the master list of the corresponding level. However it is obvious over the directed graph ACL tree structure of *Lee* that a copy must be made of a node to compare nodes in order to ultimately reduce the number of nodes to fewer nodes in order to improve traversal speed of the structure which is well known in the art **(See *Lee* pg. 9 advantages and disadvantages.)**.

i.   **Per claims 9,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 8 wherein the updated node is compared with other nodes of the master list and if

a duplicate node is found, the copied node is deleted and a pointer to the duplicate

node is provided to an ancestor node that points to the given node, a subtree pointer of

the ancestor node is updated to the duplicate node pointer, a reference count of the

duplicate node now pointed to by the ancestor node is incremented and a reference

count of the given node previously pointed to by the ancestor node is decremented **(See**

Lee for subtree on pg. 12 where a plurality of nodes 'x & y' at one level points to

one node 'y', where 'y' is interpreted as common subtree node remaining after

copied nodes are deleted. See Cheriton on col. 3 lines 46-51 for oppointers, i.e.

pointers.).

j.   **Per claims 10,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 9 wherein if a duplicate node is found in the master list, that duplicate node is

moved to an initial position in the master list **(See Lee on pg 12 where duplicates of x**

and y are given.).

k.   **Per claims 11,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 7 wherein for each node in the master list **(See Cheriton were master list is**

extended ACL list), a copy pointer is maintained, and wherein when a copied node is

compared to the master list and a duplicate node is found, the copied node is added as

a copy to the master list for use in conjunction with the processing of a subsequent rule

(See Lee on pg 12 where duplicates of x and y are given. See AAPA for ACL

rules.).

l.   **Per claims 12,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 7 wherein for each node in the master list **(See Cheriton col. 3 lines 64-66**

where extended ACL list is master list), a signature is maintained in order to facilitate

node comparisons, a full comparison of node subtrees being performed only if a match

is obtained between node signatures **(See Lee pg. 12 for common subtree node.).**

m.   **Per claims 13,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 12 wherein the signature for a given node is generated as a function of at least

one of a field value and a subtree pointer **(See Cheriton col. 3 lines 46-51 for subtree**

pointer; i.e. oppointer and col. 4 lines 5-10 for field values; i.e. source and

destination address.).

n.   **Per claim 14,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 1 wherein the corresponding actions include at least an accept action and a deny

action **(See rejection of claim 1 above where an accept or deny action is involved**

in routing the packets.).

o.   **Per claim 15,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 1 further including the step of storing at least a portion of the tree representation in

memory circuitry accessible to the processor **(See AAPA pg. 1 paragraph [0007]**

where memory is taught.).

p.   **Per claim 16,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 1 further including the step of utilizing the stored tree representation to perform an

access control list based function in the processor **(See AAPA pg. 1 paragraph [0004]**

for utilizing in the network processor, [0007] for memory, and *Cheriton* col. 2 lines

15-20 for stored tree structure.).

q.   **Per claim 17,** *AAPA* in view of *Cheriton* and *Lee* discloses the method of

claim 16 wherein the access control list based function comprises packet filtering **(See**

AAPA pg. 1 paragraph [0004] where packet filtering is taught).

r.   **Per claim 18,** rejection of claim 1 is incorporated. Claim 18 is rejected

under the same rationale as claim 1. *AAPA* in view of *Cheriton* and *Lee* discloses an

apparatus configured for performing one or more processing operations utilizing a

representation of an access control list, the access control list comprising a plurality of

rules, each of at least a subset of the rules having a plurality of fields and a

corresponding action **(See AAPA paragraph [0003] for ACL comprising rules having**

fields.), the apparatus comprising:

a processor having memory circuitry associated therewith **(See AAPA pg. 1**

paragraph [0004] for network processors and [0007] for memory circuitry.);

the memory circuitry being configured for storing **(See AAPA pg. 1 [0007] for memory circuitry)** at least a portion of a multi-level tree representation of the access control list, each of one or more of the levels of the tree representation being associated with a corresponding one of the fields **(See Cheriton cols. 2 lines 35-44 for levels of muiti-level tree representation of ACL.)**;

the processor being operative to utilize the stored tree representation to perform an access control list based function **(See AAPA pg. 1 paragraph [0004] for network processors in view of Cheriton cols. 2 lines 35-44 for tree representation to perform ACL function.)**

.wherein at least one level of the tree representation comprises a plurality of nodes **(See col. 2 lines 15-18 and 35-37, and col. 4 lines 5-9 of Cheriton where M-trie Plus data structure is a multi-level tree.)**,

with two or more of the nodes having a common subtree, the tree representation including only a single copy of that subtree; the tree representation being characterizable as a directed graph in which each of the two nodes having the common subtree points to the single copy of the common subtree **(See pg. 12 where a plurality of nodes 'x & y' at one level points to one node 'z'. 'z' is a common subtree of nodes 'x' and 'y' which are of a certain level above 'z'. Lee uses a directed graph characterization as found in claim language.)**.

Further see rejection of claim 1 for rationale of rejection to claim 18.

s.   **Per claim 19,** rejection of claim 18 is incorporated. *AAPA* in view of

Cheriton and *Lee* discloses the apparatus of claim 18 wherein the memory circuitry

comprises at least one of internal memory and external memory of the processor **(See**

AAPA paragraph [0007] memory circuitry and [0004] for processor.)

t.   **Per claim 20,** rejection of claim 1 is incorporated. Claim 20 is rejected

under the same rationale as claim 1. *AAPA* in view of *Cheriton* and *Lee* discloses an

article of manufacture comprising a machine-readable storage medium having program

code stored thereon, the program code generating a representation of an access control

list, the representation being utilizable in a processor **(See AAPA pg. 1 paragraph**

[0003] for ACL [0004] for processor, and [0007] for article of manufacture

comprising machin-readable storage medium, i.e. memory.), wherein the program

code when executed implements the steps of:

determining a plurality of rules of the access control list, each of at least a subset

of the rules having a plurality of fields and a corresponding action **(See AAPA page 1**

paragraph [0003] where an ACL generally comprises a set of rules, the rules

having fields and corresponding actions.); and

processing the rules to generate a multi-level tree representation of the access

control list, each of one or more of the levels of the tree representation being associated

with a corresponding one of the fields; wherein at least one level of the tree

representation comprises a plurality of nodes **(See Cheritan where col. 2 lines 15-18**

and 35-37, and col. 4 lines 5-9 where M-trie Plus data structure is a multi-level

tree.),

·with two or more of the nodes of that level having a common subtree, the tree

representation including only a single copy of that subtree; the tree representation being

characterizable as a directed graph in which each of the two nodes having the common

subtree points to the single copy of the common subtree **(See pg. 12 where a plurality**

of nodes 'x & y' at one level points to one node 'z'. 'z' is a common subtree of

nodes 'x' and 'y' which are of a certain level above 'z'. Lee uses a directed graph

characterization as found in claim language.).

Further see rejection of claim 1 for rationale of rejection to claim 20.

Response to Arguments

6.   Applicant's arguments filed 09/19/2007 have been fully considered but they are

not persuasive.

With regards to independent claims 1, 18, and 20, Applicant argues that the two

nodes of Lee do not share a common level of a tree representation.   However, it is well

known in the art at the time of the Applicant's invention that nodes are associated with

trees and graphs. Applicant, in claim language, states 'the tree representation' is

'characterizable as a directed graph' which is the scheme Lee teaches as seen on page

12. The direct coupling of the nodes to the common node 'z' is a one level

implementation. Lee clearly meets the breadth of the claim language and thus,

Applicant's arguments are not persuasive.

Conclusion

7.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Gai et al. (USPN 6,651,096 B1).

8.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carlene Gordon whose telephone number is (571) 272-1951. The examiner can normally be reached on 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Christian Chace can be reached on (571) 272-4190. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

10. Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Carlene Gordon
Patent Examiner
Art Unit 2165
12/03/2007

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